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AUTHOR Halyard, Rebecca A.
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ABSTRACT

Clinical Application Projects (CAPs) have been developed that allow dental hygiene and nursing students to apply introductory microbiology principles and skills learned in lecture and laboratory to a problem in an appropriate clinical situation. CAPs therefore substitute for the traditional study of "unknowns". Principles and processes emphasized in microbiology and clinical areas are reinforced and interaction between basic and clinical sciences are stressed in situations familiar to students. Nursing students are provided with "unknowns" isolated from simulated patients and simulations are developed using descriptions of disease syndromes from a variety of sources. A final report is required which includes a 4-step methodology (assess situation, plan methods of attack, implement plan, evaluate results) and organism-disease relationship (symptoms, syndromes, epidemiology, and treatment). CAPs for dental hygiene students provide experiences in oral microbiology. Organisms are collected under a variety of conditions in a dental hygiene clinic to determine the level of microbial pollution in the dental clinic and microbial contamination which rotary manipulation released from a patient's mouth. The major focus is on relating microbial population of patient's mouth to the dental history of the patient. Students have responded positively to the CAPs approach. (Author/JN)

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Rebecca A. Halyard
Associate Professor of Biology
Clayton Junior College
Morrow, Georgia 30260

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Clinical Application Projects (CAPs) for Health-Science Students in Introductory Microbiology

Microbiology courses for health-science students generally emphasize the relationship between microbes, health, and disease. Understanding of this relationship is developed through the use of lectures and laboratory experiences. Characteristics of microbes and the disease syndromes are typically addressed in lectures, while techniques used to study microbe characteristics are practiced in the laboratory.

In many beginning microbiology courses, students are given an "unknown" to identify in the laboratory; this exercise helps students to prove their ability to integrate their knowledge of microbes (and chemistry) with the technical skills acquired in the laboratory. The "unknown" is usually given to the student as a culture of organisms or mixture of organisms. No further information about the culture is given. Identification of the "unknown" requires the student to be familiar with a variety of media and to have these media available; the student must also have a firm understanding of the biochemistry of microbes if this exercise is to be worthwhile. Health-science students (primarily nursing and dental hygiene) typically lack the knowledge of biochemistry necessary to pursue a meaningful study of the unknown, and therefore have in many instances failed to see the significance of their endeavors. A lot of media appeared to be wasted as students had neither the background, experience, or time to understand the relationship between identifying an unknown presented in the classic manner to their own clinical experiences.

Clinical Application Projects (CAPs) have been developed that allow students to apply introductory principles and skills learned in lecture and laboratory to a problem in an appropriate clinical situation. CAPs therefore

substitute for the classical study of "unknowns". CAPs have been developed for both dental hygiene and nursing students, using input from faculty in both clinical areas. Students in both programs are therefore able to directly use microbiology in a situation that is familiar to them. In developing the projects, effort has been made to reinforce principles and processes emphasized in both microbiology and the clinical areas, and to stress the interaction between the basic and clinical sciences. CAPs have been used by students at Clayton Junior College, a unit of the University System of Georgia. These students have completed a minimum of one quarter of college chemistry and a two-quarter human anatomy and physiology sequence. Approximately ninety (90) students complete the CAPs during a quarter.

CAPs for Nursing Students

Nursing students are provided with "unknowns" isolated from simulated patients. No more than two students in the same laboratory section have the same "patient". Cultures are of opportunistic pathogens, several of them the etiologic agents of common nosocomial infections. Because these organisms are only opportunistic pathogens and are very attenuated, students are skilled enough to work with them without endangering themselves or others! In fact, most of the organisms are those that students have used to learn the basic microbiological techniques. Examples of unknowns that are used include: *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Streptococcus mitis*, *Proteus vulgaris*, *Candida albicans*, and *E. coli* among others. Again, none are fresh isolates.

Students are given the cultures as "isolates" from simulated patients. The simulations are developed using descriptions of disease syndromes from a

variety of sources. Two typical simulations are given below as examples.

No. _____

Isolated from blood of patient, age 56. Patient has been undergoing dialysis.

Symptoms:

1. fever
2. chills

No. _____

Isolated from blood of patient, age 8. At age 7, child suffered a compound fracture of the proximal tibia.

Symptoms:

1. chills
2. fever
3. pain, redness, swelling in knee
4. WBC 15,000

Students work independently on their projects during their assigned laboratory periods. Projects are completed in two to three weeks.

CAPs for nursing students are carried out using the following objectives:

1. Design a valid procedure for identifying the organism.
2. Carry out the procedure to the extent possible.
3. Identify the organism.
4. Identify a probable disease and discuss it with relation to the causative organism.

Students are given guidance in planning their methodology for identifying the problem. A four-step problem-solving procedure based on the "nursing-process" is provided to the students. The nursing-process is the application of precise problem-solving methods to particular nursing situations. The four

steps are:

1. Assess the situation. (Describe the problem and possible causes of it.)
2. Plan methods to attack the problem. (Describe procedures used to attack the problem.)
3. Implement the plan. (Give results)
4. Evaluate the results. (Give conclusions.)

Students respond to each of the four steps in their final report. References housed in both the laboratory and the library are used for the identification of the organism and the disease which the patient is suspected of having. The relationship between the organism and the disease is studied last, and the study includes the following four aspects of the disease:

1. symptoms
2. syndrome
3. epidemiology
4. treatment

In the final report, therefore, the student identifies the unknown organism (at least to genus), describes the procedures used to identify the organism, identifies the disease caused by the organism, and provides information about the disease. The nursing students, through carrying out CAPs are able to see how knowledge of microbiology can be used in a clinical situation that involves the nursing process.

CAPs for nursing students require a minimum of preparation on the part of the laboratory staff. Students request media (e.g. blood agar, V-8 juice agar, motility agar) in writing, stating why they think they need it. This drastically cuts down in the haphazard use of media, lowering both expenses and preparation time. It should be noted that all organisms, media, and

techniques required for CAPs have been introduced and used in the six weeks of laboratory experiences completed prior to starting CAPs. The diseases have been discussed in lecture and studied in the text. Nursing students feel quite confident in their ability to pursue a CAPs project because they are familiar with all the components in other contexts.

CAPs for Dental Hygiene Students

CAPs for dental hygiene students give the students first-hand experience in the study of the microbiology of the oral cavity. Organisms are collected under a variety of conditions in the dental hygiene clinic located on the college campus. The students proceed with their projects independently both in the clinic and in their assigned microbiology laboratory period. Projects are completed in two to three weeks.

CAPs for dental hygiene students are carried out using the following objectives:

1. Determine the level of microbial pollution in the dental clinic.
2. Determine the level of microbial contamination which rotary manipulation released from the patient's mouth.

Dental hygiene students therefore are to analyze microbes found in the clinic and those released from their patients' mouths during several types of rotary manipulation. This is a non-invasive procedure. Their study is completed by relating the microbial population of their patient's mouth to the dental history of the patient. Students also compare their findings with those of other students.

At the start of the CAPs, each dental hygiene student is given five blood agar plates and two V-8 juice agar plates. To study the clinic environment, a blood agar and a V-8 juice agar plate is exposed for 30 minutes at the

beginning and again at the end of the clinic period. The remaining blood agar plates are held in front of a patient's mouth during no manipulation (control), low-speed rotary manipulation (patient exposure), and high-speed rotary manipulation (trutorq hand-piece or drill, if available). The data are collected and analyzed as follows:

	Colonies (#)	
	Blood Agar	V-8 Juice Agar
Beginning of clinic		
End of clinic		
Patient control		XXX
Patient exposure		XXX
Patient high speed		XXX

Molds and yeasts from the V-8 juice plates are stained with lactophenol cotton blue, and are identified to the extent possible. By determining the numbers and kinds of microbes in the clinic environment, students appreciate the importance of asepsis in the clinic area.

Gram stains are made of the colonies from the incubated blood agar plates. Sub-culturing is carried out as needed within the constraints of time.

A record of results from the blood agar plates similar to the example below is maintained by students.

Patient High-Speed Plate

	No. of Colonies
Gram +	
Cocci	
Rods	
Gram -	
Cocci	
Rods	
Spirochetes	

Occasionally students have carried out the Snyder test in the clinic and added this data for comparison to the dental history. The Snyder test is not

required of students, however, because of difficulties encountered when collecting the saliva from the patient. Nervous patients produce little saliva! The CAPs projects have presented little problem in the dental hygiene clinic, as students help each other organize the plates, hold them at the patient's mouth, etc. Collecting saliva is more difficult and interferes to a greater extent with the routine clinical procedures.

Summary

Both dental hygiene and nursing students have responded positively to the CAPs experience. The quality of reports is high. About seven percent of the nursing students "miss" the unknown altogether. Most of these students contaminated their culture and then worked with the contaminant. Students also have more trouble with the gram negative rods.

Dental hygiene students have diverse findings and get quite excited about the variety of organisms they collect. Some joke about starting to wear a mask! Their major limitation is time to investigate the organisms they collect, and to compare their findings with each other and their resource texts.

The time frame for the CAPs is given below.

	Nursing	Dental Hygiene
Week 1	Get "isolate" and patient	Pick up plates and expose in clinic
	Make stains	Begin to examine plates in lab: stains and subculture
	Subculture	
Week 2	Continue to sub-culture and research	Continue examinations of plates: stains and subculture
Week 3	Write report	Write report

CAPs projects have been used by several microbiology professors at Clayton Junior College and each has found them to help students better understand the relationship between microbes, health, and disease. A watchful eye is kept for possibilities for new simulations and experiences for CAPs. References found to be helpful for the projects are given below.

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